Title of Investigation:

SimSat Safety and Development

Principal Investigator:

Mr. Pat Kilroy, Code 568

In-house Members of Team:

Mr. Jack Vieira, Code 840 Wallops; Mr. Freeman "Chip" Blackwell, Co-Investigator, Code 569 Wallops; Ms. Carolyn Harden, Co-Investigator, Code 130.3; Mr. Tim Sauerwein, Head, Code 568; Dr. John Day, Chief, Electrical Engineering Division, Code 560; Mr. Carroll "Trick" Trickey, Code 568 (OSC).

External Collaborators:

Various university student interns; numerous Amateur Radio experimenter-volunteers, including but not limited to Mr. Hugh O'Donnell and selected fellow members of the Goddard Amateur Radio Club, Inc; Mr. Chuck Jacob, Code 452 (HTSI), Wallops; Mr. Ben Lui, NASA manager, Code 870; Mr. John Hoge, NASA engineer (QSS) and scoutmaster, BSA Venture Crew 173, Westminster, Md.

Initiation Year:

2004

Aggregate Amount of Funding Authorized in FY 2003 and Earlier Years:

N/A

FY 2004 Authorized Funding:

$25,000

Actual or Expected Expenditure of FY 2004 Funding:

Greenbelt: $16,000 (est) for equipment purchases and supporting materials.
Wallops: $9,000 (est) for materials and labor.

Status of Investigation at End of FY 2004:

To be continued in FY 2005 with additional expected FY 2005 DDF funding of $39,920 plus 0.85 FTE labor hours for the P.I. and 1.10 FTE for key others.

Expected Completion Date:

September 30, 2005

Purpose of Investigation:

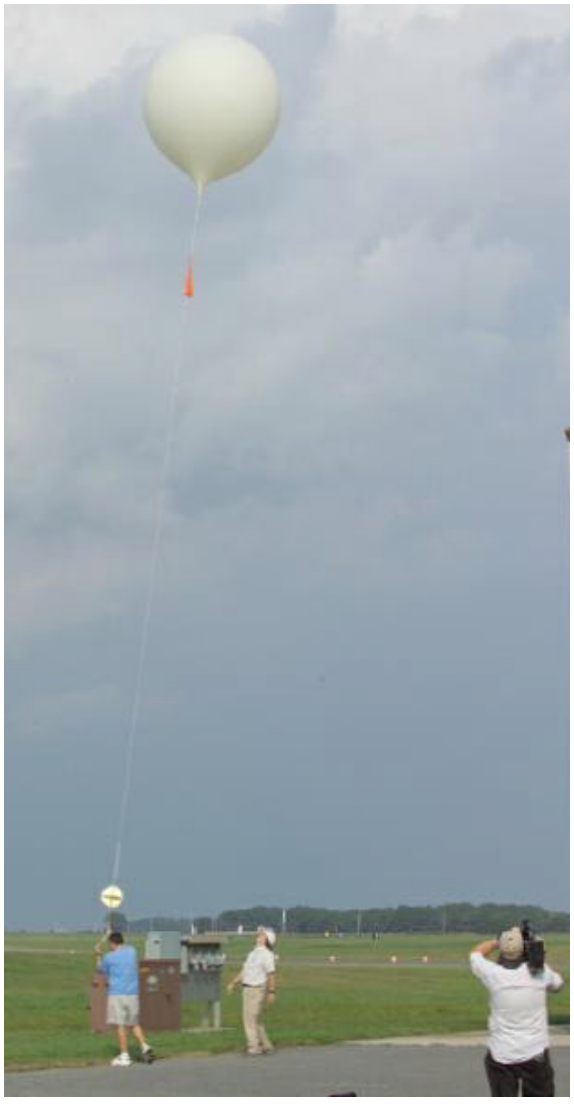
To explore how to influence more students and allow NASA to reach them in a way closer than ever before by developing a radically new flight project under an education department (rather

than the other way around). On a shoe-string budget we set out to (1) determine how to launch a small, high-altitude balloon to fly safely in shared, populated airspace; (2) explore new and exciting SimSat bus, flight and ground system developments and applications meant to catch the eye and hold the interest of students and the public, including testing the feasibility of flying a standard commercial IEEE 802.11b "WiFi" unit as an S-band transponder that establishes a temporary student flight comm link to unite schools; (3) produce safety analysis, range safety products and environmental documentation geared initially toward an engineering test flight at Wallops Island; (4) identify concomitant products required to take a future launch on the road and to develop ground crew training; (5) continue previous, and explore new, partnerships (e.g., universities, community groups) to assist in developing SimSat flight services; and (6) identify pilot schools and hold SimSat telemetry compatibility tests.

FY 2004 Accomplishments:

The number and type of accomplishments were pretty amazing in FY04 considering the severe disadvantage and cutbacks we braved from the onset. The disadvantage was condensing a nearly 12-month full initiative into a strapping 6-month schedule. The cutbacks were the nearly one-third reduction in budget and a premature lockout of labor hour expenditure.

The primary accomplishment culminated in the successful launch and tracking of an expendable engineering test payload. The payload was largely designed and fabricated by a team of two Worcester Polytechnic Institute (WPI) student interns. In fact, a second similar flight completed its mission within 24 hours of the first with success as well. The second payload was expendable by design, yet not without high value to the P.I. for analysis reasons and historical appeal. After



drifting afloat for 10 days in the Atlantic Ocean the payload was recovered and returned by two 11-year old students vacationing with their families on the North Carolina beachfront.

The overall progress can be enumerated against the list provided in the above purpose paragraph. (1) Before trying to fly in shared, populated airspace, NASA range safety personnel wanted to obtain familiarity with the SimSat design and performance. A series of test flights were arranged at Wallops. The SimSat flight train assumed the basic appearance of a NOAA National Weather Service (NWS) radiosonde for simplicity and one which Wallops has a great deal of experience flying. (2) Two teams of two students, two other students working independently plus a local Boy Scout troop developed payloads. The width and breadth of their accomplishments exceeded that promised by the P.I. for the past fiscal year. (3) Coordination meetings and documentation composure were completed prior to the first missions. These satisfied the Wallops Island range requirements for the minimum test flights and more. However, most requirements to launch at a location away from the Wallops Island range are being considered under a separate case. Separately, we encountered a conflict with the Center IT Security force in Greenbelt regarding wireless emissions; as a result, we are pursuing a waiver for our unique experiment. (4) A separate plan and cost estimate were initiated aimed at supporting at least one mission away from Wallops. The costs are reflected in our DDF extension proposal. As it turned out, we lost one of our co-investigators to priority work and missed developing our own ground crew and the training materials for future ground personnel. Wallops personnel were used in their stead. (5) A student from the NASA Academy as well as an especially accomplished one from the GSFC Student Internship Program (SIP) proved indispensable on the team during the spring and summer. Students from the annual GSFC collaboration with WPI on their Major Qualifying Project (MQP) program followed the summer students. WPI's MQP is similar to a senior project performed at a remote site off campus. It allows selected students to satisfy graduation requirements for their respective department. This source showed good quality collaboration in our branch. (6) An important inroad to a school in Howard County as a potential SimSat pilot school fell through and a new opportunity arose with scout troop Venture Crew 173, most of whose members attend Westminster High School in Carroll County, Maryland. These young men were outstanding serving as a remote ground station on the SimSat-1B mission copying its telemetry realtime. They also published a press kit while preparing for the mission, and once accomplished, widely distributed a nice press release heralding their successes. We enjoyed an ice breaker meeting with two NASA Explorer Schools (NES) program coordinators at Goddard and NASA Headquarters.

Planned Future Work:

Our plan for SimSat is to continue and complete the tasks described above. After the DDF and some further program refinements, SimSat is looking forward to finding a new "home" and becoming "operational" in a step-wise fashion. Our first choice for that home is under a GSFC wing of the NASA Explorer Schools program. This is a key goal for the next fiscal year.

Summary:

Too many educational components of flight projects require students to travel to a distant NASA site to support a portion of a mission. Travel away from home and school prevents most students from participating due to expense, logistical nightmares, resource location and availability, schedule conflicts and liability issues to name but a few.

SimSat has the potential to bring a complete, four-hour NASA flight mission to their own football field. A high school can build and fly its own payload. Payload flight schedules are measured in weeks; payload re-flight opportunity is excellent. SimSat will allow students and mentors to set up a real ground and tracking station at many neighboring schools and homes at an outrageously low cost by using off the shelf Amateur Radio technology.

This is truly a hands-on opportunity for students: SimSat catches the fascination and trains future engineers who may "care less about the content of the telemetry as compared to the path with which the data takes" to become useful.

There is risk associated, but the potential benefits of SimSat are toogreat and too many to not explore further.

Venture Crew 173

20 Ridge Road • Westminster, Maryland 21157

CARROLL DISTRICT SCOUTS DO A GOOD TURN FOR NASA

(Westminster, MD, 1 Oct, 2004) Venture Crew 173 participated in an engineering test flight of the NASA Simulated Satellite (SimSat) program. SimSat is an educational program that flies simple, student-built payloads to a "near-space" altitude using a small weather balloon. Crew members operated a ground tracking station near Westminster to receive and decode telemetry from the payload.

The first test balloons were launched from Wallops Island, VA, on Thursday, 30 September, and Friday, 1 October. Crew 173 received data from the Friday flight. The scouts assembled a tracking station using their ham radio gear and personal computers.

There were two amateur radio transmitters in the Friday payload. "One operated with about the same power as the transmitter in a garage door opener. The more powerful one was about as strong as a cell phone," said William Hoge, Crew President. "It wasn't easy to receive such weak signals from over 100 miles away." Although the more powerful transmitter failed soon after launch, the scouts were able to receive a useable signal from the weaker transmitter for over an hour. At that point, NASA radar showed that the balloon was above 75,000 ft.

Other amateur radio operators from as far away as Pennsylvania were able to receive signals from the Friday flight. Signals from the more powerful transmitter were received by an amateur radio operator in Ontario during the flight on Thursday.

The initial payloads carried simple telemetry systems to report the inside and outside air temperature from the balloon. Future payloads are to include GPS location data for the balloon.

Venturing is a part of the Boy Scouts of America open to young men and women from 14 to 20 years old. Venture Crew 173 specializes in activities related to communications such as computer programming and amateur radio. It is sponsored by a group of Carroll County amateur radio operators.

Andrew Young , KB3GUY, and William Hoge, KB3GHE, ponder data received from SimSat 1B.

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